



US007122057B2

(12) **United States Patent**  
**Beam et al.**

(10) **Patent No.:** **US 7,122,057 B2**

(45) **Date of Patent:** **Oct. 17, 2006**

(54) **METHOD AND APPARATUS FOR  
ENGINEERED REGENERATIVE  
BIOSTRUCTURES SUCH AS  
HYDROXYAPATITE SUBSTRATES FOR  
BONE HEALING APPLICATIONS**

(52) **U.S. Cl.** ..... 623/23.51; 623/23.56

(58) **Field of Classification Search** ..... 623/16.11,  
623/23.51, 23.61; 419/2, 5; 264/43, 44;  
424/423

See application file for complete search history.

(75) Inventors: **Heather Ann Beam**, North Brunswick,  
NJ (US); **Thomas J. Bradbury**,  
Yardley, PA (US); **Kathleen D.  
Chesmel**, Cream Ridge, NJ (US);  
**Christopher M. Gaylo**, Princeton  
Junction, NJ (US); **Alfred Anthony  
Litwak**, Manasquan, NJ (US); **Qing  
Liu**, Lawrenceville, NJ (US); **Peter  
Albert Materna**, Metuchen, NJ (US);  
**Donald Monkhouse**, Radnor, PA (US);  
**Jennifer Patterson**, Seattle, WA (US);  
**Timothy J. Pryor**, Yardley, PA (US);  
**Sunil Saini**, Plainsboro, NJ (US);  
**Henry Leon Surprenant**, Phoenixville,  
PA (US); **Chen-Chao Wang**, West  
Windsor, NJ (US); **Thomas George  
West**, Lawrenceville, NJ (US); **Jaedeok  
Yoo**, West Orange, NJ (US)

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,662,405 A \* 5/1972 Bortz et al. .... 623/23.51  
3,713,860 A 1/1973 Auskern ..... 117/8.5  
4,000,525 A 1/1977 Klawitter et al.  
4,158,684 A 6/1979 Klawitter et al. .... 264/43  
4,192,021 A \* 3/1980 Deibig et al. .... 623/23.61

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0395187 A2 10/1990

(Continued)

OTHER PUBLICATIONS

Portions of TheriRidge 510(k) FDA Submission.

*Primary Examiner*—Eduardo C. Robert

*Assistant Examiner*—David Cornstock

(74) *Attorney, Agent, or Firm*—Robert H. Eichenberger;  
Middleton Reutlinger

(73) Assignee: **Therics, LLC**, Akron, OH (US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 341 days.

(21) Appl. No.: **10/122,129**

(22) Filed: **Apr. 12, 2002**

(65) **Prior Publication Data**

US 2003/0065400 A1 Apr. 3, 2003

**Related U.S. Application Data**

(60) Provisional application No. 60/283,564, filed on Apr.  
12, 2001.

(51) **Int. Cl.**  
**A61F 2/28** (2006.01)

**60 Claims, 26 Drawing Sheets**  
**(3 of 26 Drawing Sheet(s) Filed in Color)**

(57) **ABSTRACT**

An engineered regenerative biostructure (erb) for implanta-  
tion into a human body as a bone substitute, which includes  
an internal microstructure, mesostructure and/or macro-  
structure to provide improved bone in-growth, and methods  
for making the erb. Under one aspect of the invention, the  
biostructure has resorbable and nonresorbable regions.  
Under another aspect of the invention, the biostructure is  
constructed of hydroxyapatite, tricalcium phosphate and/or  
demineralized bone. Under yet another aspect of the inven-  
tion, the porous biostructure is partially or fully infused with  
a resorbable, nonresorbable or dissolvable material.

